

Unsupervised clustering analysis of spectral data for the Rudaki area on Mercury

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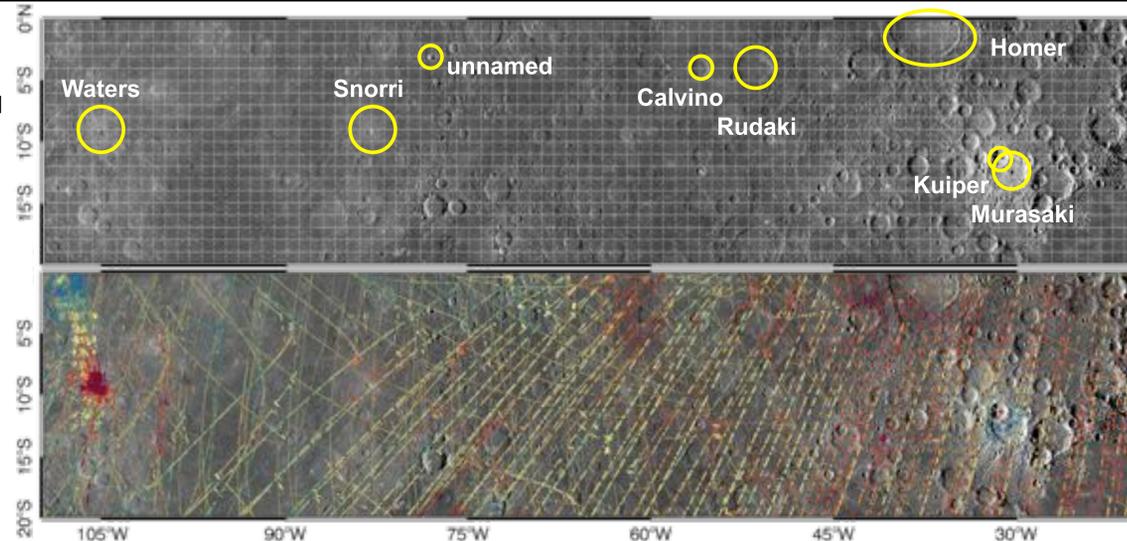
Abstract

We present a study of spectral reflectance on Mercury focused on an area that encompasses the craters Kuiper, Rudaki, and Waters. The goal is to analyze possible connections among different terrain types. The study region is geologically and spectrally classified as heavily cratered intermediate terrain (IT) and mixed patches of high-reflectance red plains (HRP) and intermediate plains (IP), on the basis of multispectral images taken by the Mercury Dual Imaging System (MDIS) [1]. Recent analysis of observations by the Mercury Atmospheric and Surface Composition Spectrometer (MASCS) instrument on the MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft with an unsupervised hierarchical clustering method shows at global scales a comparable number of units [2,3]. Analyses on the local scale reveal a larger number of units and with a substantially more complex relationship among units.

Area selection and data regridding

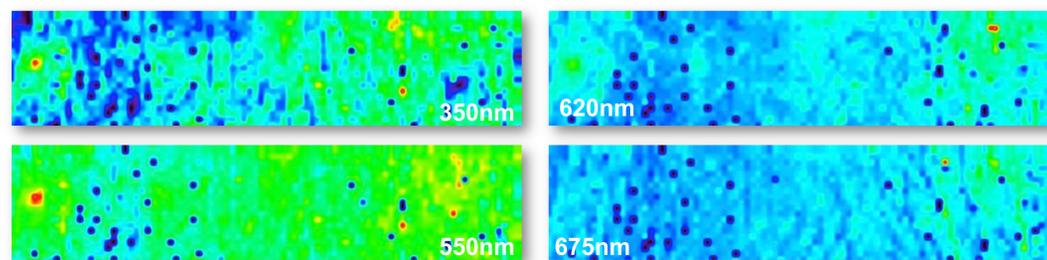
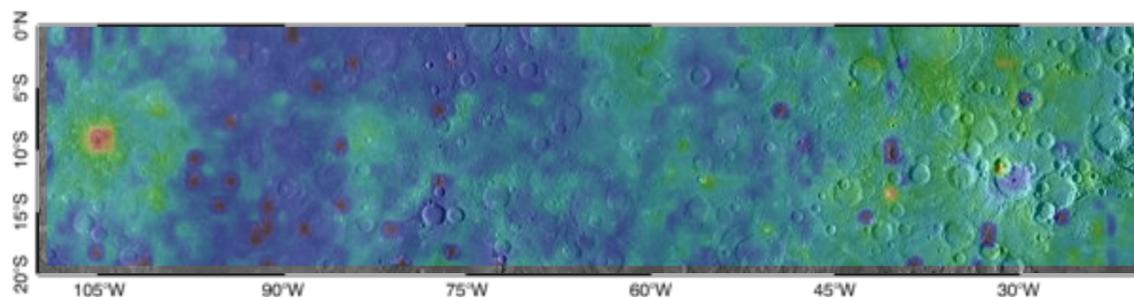
The study area is divided in a regular grid of 1 deg x 1 deg (the grid is created and Queried in the Postgres database as described in [7]).

The MASCS dataset is filtered to obtain observations falling in each single pixel and quality parameter (i.e. low detector temperature and incidence angle). The figure color code shows the normalized reflectance at 350nm.



Spatial Distribution

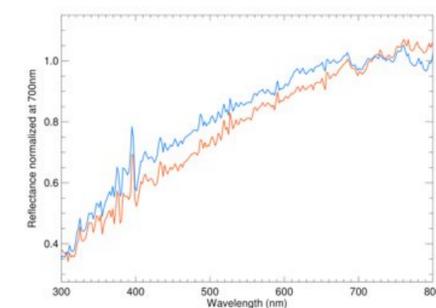
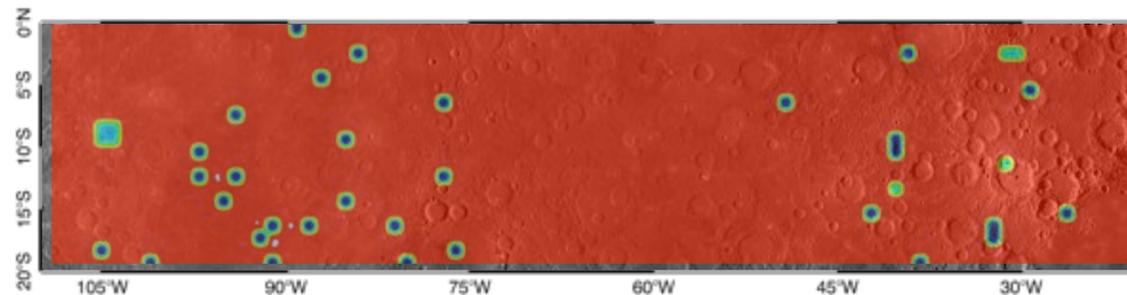
Normalized reflectance at 450nm



Unsupervised Clustering

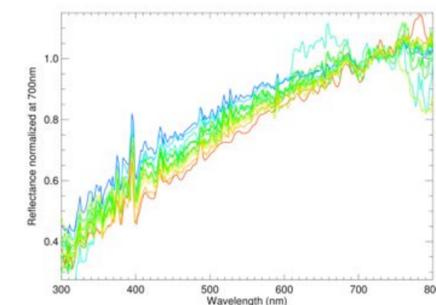
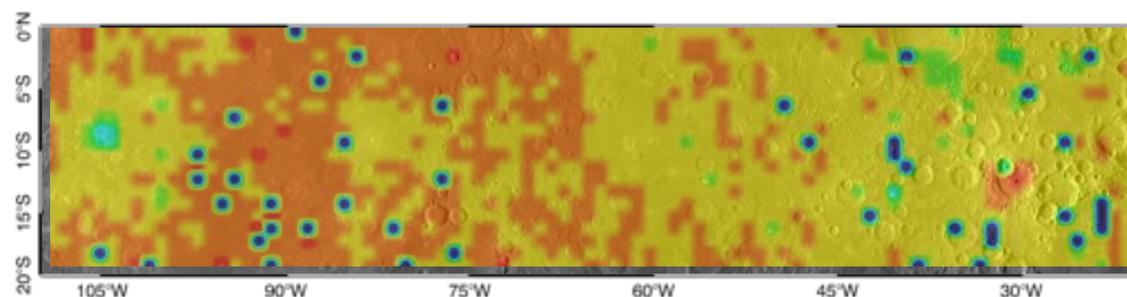
1st step. Separation of the first cluster.

Waters crater area, Kuiper and an area east Homer belong to the same cluster, bluer than the background.

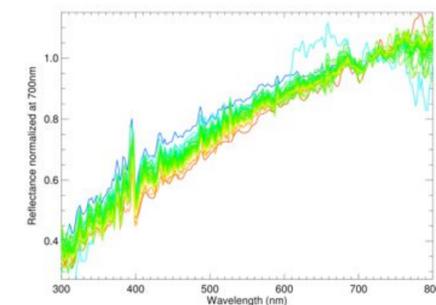
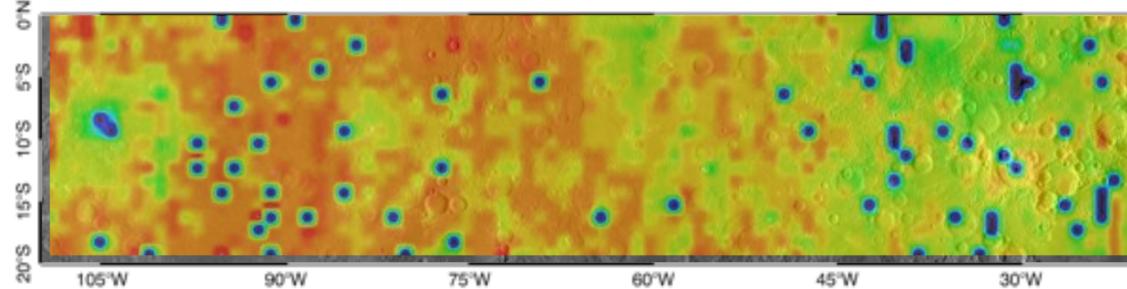


2nd step. The background longitudinally breaks in 2 slightly different, yet reddish units (yellow/orange).

Waters ejecta differentiate from encircling terrains, being spectrally in between the deep-blue Water interior and an extremely red small unnamed crater in the north. Kuiper/Murasaki separates from its background material. Some cluster middle-red (green color code) appears near Homer.



3rd step. The yellow background unit on East breaks in two sub units. The Waters ejecta stay in one of the East cluster sub-units, different from its surroundings.



References

[1] Denevi, B. W. et al. (2009), *Science*, 324, 613-618; [2] Helbert, J. et al. (2013), *JGR*, in preparation; [3] D'Amore, M. et al. (2012), *LPS*, 43, 1413; [4] Helbert, J. et al. (2013), *LPS*, 44, this meeting; [5] Ernst, C. M. et al. (2010), *Icarus*, 209, 210-233; [6] D'Incecco, P. et al. (2013), *LPS*, 44, this meeting; [7] D'Amore, M. et al. (2013), Poster n. 1900 *LPS*, 44, this meeting.